character and amount of water rights. Experiments are being made to determine how far drainage can be made to protect hillsides from destructive effects of erosion. In the whole country there are 100 million acres of swamp and poor lands, which can be reclaimed only through drainage.

Of the new buildings the secretary says that the structures now being built will cost about one and one half million dollars, and should be completed in two years, by which time it is hoped that further appropriations will be available to continue the building work inaugurated.

Speaking of the growth of the department, the secretary reports the number of persons on the rolls July 1, 1905, to be 5,446. Of these, 2,326 are rated as scientists and scientific assistants. This shows an increase since July 1, 1897, of 3,003 persons on the rolls of the department, of which the increase in the number of the scientific staff in the same period was 1,401.

In conclusion, the secretary says it has been a grateful task to present to the president and thus to the American people a pen picture of the American farmer as he is to-day, to make clear the position of the farming industry, its wonderful productiveness, and its large contribution to the general prosperity of the country. He has also pointed out some of the more important work illustrative of the methods by which the department seeks to benefit the farmer. Its work is two-fold. It seeks to add to the sum of intelligence in the man and to increase the productive capacity of the acre. In this work the department has the hearty cooperation of the agricultural colleges and experiment stations, all working with the department to the same great end. The gratifying evidences of well-being in the farming community, the extraordinary progress made, and the enlarged recognition of the true position of the farming industry in the economic life of the country are mainly the result of this continued and combined effort on the part of these agencies to add to the sum of the farmer's knowledge, and must be regarded as the triumph of intelligence in the application of scientific knowledge to the tillage of the soil. This he maintains is so true that it would be superfluous to urge the generous maintenance of the department in its grand work.

Great as has been the work undertaken and accomplished, gratifying as have been the results as shown in the first few pages of this report, be it remembered that we are still at the threshold of agricultural development and that the educational work which has led to such grand results has only been extended as yet to a portion of our agricultural population.

## *SCIENTIFIC BOOKS.*

### NEWCOMB'S REMINISCENCES.[1]

When a man lays down the arduous pen of the mathematician, which he has used throughout a long life to the admiration of the world, and takes up in leisurely fashion that of the autobiographer, he is tolerably sure of our respectful attention. But Professor Newcomb has won from us far more than this: he has earned our lasting gratitude by the production of a book which is delightful to read and which makes several contributions to the history of astronomy. Of the eminently readable character of the book it is easy to assure oneself by opening it at random, for on almost every page there is an anecdote or the equivalent, rendered accessible to the lay reader, where necessary, by admirable exposition of astronomical terms and touched infallibly with a genial humor. The variety of topic is specially noteworthy; the author is as much at home in explaining why the United States results from the Transits of Venus were not reduced (because after spending $375,000 on the observations it was found to be impossible to secure $5,000 for the computations—see p. 178) as he is in vividly sketching Mr. Gladstone thus:

[1] 'The Reminiscences of an Astronomer,' by Simon Newcomb. Houghton, Mifflin & Co., 1903.

It could not be said that he had either the dry humor of Mr. Evarts or the wit of Mr. Depew; but these qualities were well replaced by the vivacity of his manner and the intellectuality of his face. He looked as if he had something interesting he wanted to tell you; and he proceeded to tell it in a very felicitous way as regarded both manner and language, but without anything that savored of eloquence (p. 276).

Or we may turn to another page and find a note, brief but vigorous, on the visit of Dom Pedro of Brazil 'the only emperor who had ever set foot on our shores.' (May we Englishmen hope that the Emperor of India will be the second?) On another page is a good story of Argelander and Gould.

When with him [Argelander] as a student, Gould was beardless, but had a good head of hair. Returning some years later, he had became bald, but had made up for it by having a full, long beard. He entered Argelander's study unannounced. At first the astronomer did not recognize him.

"Do you not know me, Herr Professor?" The astronomer looked more closely. "Mein Gott! It is Gould mit his hair struck through!"

[By the way, there is a little misprint in the German.]

But, as above remarked, there are many real pieces of astronomical history, related with the same charm of simple directness. We may surely rank as such the incidents connected with the discovery of 'Lane's Law,' for instance. Newcomb was walking home after a scientific club meeting with Mr. Taylor and—

A little man whose name he did not even know, as there was nothing but his oddity to excite any interest in him, and on the way was explaining a theory to his companions in that *ex cathedra* style which one is apt to assume in setting forth a new idea to people who know little or nothing of the subject. My talk was mainly designed for Mr. Taylor because I did not suppose the little man would take any interest in it. I was, therefore, much astonished when, at a certain point, he challenged, in quite a decisive tone, the correctness of one of my propositions, * * * informing us that he had investigated the whole subject and found so and so—different from what I had been laying down. * * * Naturally I cultivated the acquaintance of such a man. His name was J. Homer Lane (p. 247).

And again we may put in this category the generous record of the fact that the genius of the Clarks as makers of object-glasses was first recognized in England; the agent being the Rev. W. R. Dawes, who saw, from a letter sent him by Mr. Clark,

describing a number of objects which he had seen with telescopes of his own make, that the instruments must be of great excellence, and ordered one or more of them. "Not until then were the abilities of the American maker recognized in his own country" (p. 149).

Or again we may reckon as a historical incident the vindication, by Professor Newcomb himself, of Father Hell, who had half a century earlier been accused by Littrow of forging records of observations of the Transit of Venus. By protracted study of the original manuscripts, Newcomb was led to suspect that Littrow could not see differences in color between inks, and on inquiry learned that he was color-blind.

No further research was necessary. For half a century the astronomical world had based an impression on the innocent but mistaken evidence of a color-blind man respecting the tints of ink in a manuscript (p. 160).

It was not the only occasion on which Professor Newcomb inferred a fatal flaw in eyesight from faulty work. On taking charge of the Nautical Almanac Office he found that his proof-reader could not read proofs—he did not appear to see figures, or be able to distinguish whether they were right or wrong, and, therefore, was useless as a proof-reader. "It is not his fault," was the reply; "he nearly lost his eyesight in the civil war, and it is hard for him to see at all." In the view of counsel this ought to have settled the case in his favor (p. 215). We may put alongside this story Airy's condition of efficiency in another kind of assistant. "I never," he said, "allow an operator who can speak with the instruments to take part in determining a telegraphic longitude" (p. 290). For the explanation we must refer the reader to the book itself.

Airy is referred to by the author as 'the

most commanding figure in the astronomy of our time.' Perhaps the same phrase may be used, with alteration in date, of Newcomb himself. At any rate, his figure is conspicuous enough to justify many times over the autobiographical references in the early part of the book, for which he makes a modest apology in the preface. We are sure that the opinion of the friends who urged their publication will be endorsed by a wide circle of readers. To be able to identify the Newcomb we know—the man who courageously set out to reduce to order a vast mass of heterogeneous accumulated observations, and who did it—with the child who taught himself to add by using a bed-quilt as an abacus; with the boy who listened to an astronomical lecture by his father (somewhat as J. Homer Lane afterwards listened to Newcomb himself) and then said, 'Father, I think you were wrong in one thing' (the story is told by the father); with the youth who was apprenticed to a quack doctor and ran away because he could not stand the quackery; with the man who became perforce a soldier at a moment's notice —there is surely nothing of harm in our being allowed this possibility, and equally surely there is much of good. We are grateful to the author for putting aside his own natural feelings in the interests of his readers.

A critic is morally bound to devote one paragraph to complaints, and we will complain of some deficiency in references. There is, for instance, a chapter on 'Scientific England,' describing a visit to Europe with no date attached. After looking through the chapter in vain for a date, we turned to the index for the eclipse which is referred to several times in the chapter as supplying the motive for the expedition. It is not mentioned in the index! Another eclipse (that of 1860, observed in America by Newcomb) is indexed, but there is no reference to the one mentioned at least half a dozen times in Chapter X.

But having fulfilled this critical duty, we gladly return to the more congenial attitude of commendation, and say that the book is beautifully printed, and that there is an excellent portrait of the author as a frontispiece, which is in itself enough to make the book worth buying.

H. H. Turner.

University Observatory, Oxford,
November 11, 1905.

*Naturkonstanten in alphabetischer Anordnung.* By Professor Dr. H. Erdmann and Privatdocent Dr. P. Koethner. Berlin, Julius Springer. 1905. 8vo. Pp. 192.

This book on 'Constants of Nature' is mainly a collection of tables, containing such information as, in the opinion of the authors, is most frequently needed in chemical and physical calculations. The selection made seems in general to be a good one, though some additions might have made it more useful to the physicist. For example, there is no table of the density of mercury at different temperatures, no magnetic data, and under the discussion of temperature measurement no mention of thermocouples or pyrometers.

The subject matter is arranged alphabetically and the book is furnished with a handy thumb index. In the selection of headings two distinct principles have been employed. We find (1) the chemical elements—including their salts—with the most important data relating to them and (2) a discussion of physical and chemical methods of measurement with tables containing the numerical constants for various substances. For example, under 'Iron' the density, melting point and boiling point of the element, the lines of its arc and spark spectrum are given; then follow the molecular weight and density of twenty, the solubility at different temperatures of seven iron salts, the multiples and their logarithms of the atomic weight, the specific gravity of $FeSO_4$, $FeCl_3$ and $Fe_2(SO_4)_3$ solutions of different concentration and finally the logarithms of constants, frequently used in chemical analyses, for example

$$\log \frac{Fe_2}{FeO} \text{ or } \log \frac{FeSO_4 + 7aq}{FeO_3}.$$

This will show the great usefulness of the book, especially for chemical work. Such an arrangement proves in a great many cases more convenient and—if we can speak of such a thing in a collection of tables—more inter-

esting than the arrangement usually followed.

Interlarded with the elements are the separate headings for chemical, physical and mathematical constants, for instance: Analysis, solutions, acoustic, electric, optical and critical constants, logarithms and antilogarithms. The table of atomic weights is based on the values, published by the international committee for 1905.

In some of these cases it might have been better to combine such headings as 'Barometer,' 'Gases' (with reduction of barometric readings) and 'Air'—or 'Freezing Mixtures,' 'Temperature Measurement,' 'Thermochemistry' and 'Heat Constants,' instead of having each in a different part of the book. There are, however, a large number of cross references and an excellent index to facilitate its use.

In these chapters on constants the authors have added some text, containing definitions, derivations and explanations of the more important formulæ, and frequent valuable references to the literature. The chapter on 'Units' is the weakest part, since several mistakes and many loose statements have crept in which should not occur in a book of this kind. The gram is defined as the weight of one cubic centimeter of water at 4° C., instead of the concrete unit; density and specific gravity are used as synonyms. While the numerical values may be identical, namely, if we adopt as unit volume the milliliter, or the wrong definition of the gram (as mass) given by the authors, the two names have not the same physical meaning. The metric equivalent of the English yard is given incorrectly and as the two units of capacity in the United States we find the gallon and the cask, the latter to equal 121.1296 liters. The reviewer feels confident that with him many readers of SCIENCE are ignorant of the existence of such a unit, though certainly one of this size might exist in addition to the many others. The bushel, however, is not given. It would have been well to add to the metric horsepower, as used in Germany, the equivalent of the English horsepower. The electrical units have not been defined in accordance with international agreement or with the values legalized in Germany; that the E.M.F. of a Clark standard cell is given as 0.69735 volt—the reciprocal of its actual value—may be an oversight.

A distinction, though by no means clear, seems to be made between 'Masse,' 'Gewicht' and 'Schwere,' the second probably corresponding in meaning to Holman's 'Weightal,' *i. e.*, the quantity of substance as measured by weighing; but the use of the first two as synonyms and the statement that the gram-weight is one of the units of the c.g.s. system (see also: One Joule = 0.1019 mkg.) leads finally to an evaluation of the 'weight' of the sun instead of its mass.

While the reviewer may appear over-particular in such questions, it can not be sufficiently emphasized how harmful mistakes of this kind are. Like a fog in an otherwise beautiful landscape, they have led many a man off the right road. But this book is principally intended for those who have passed the danger point or are not concerned with definitions of this kind, and for such it will prove to be very useful on account of its handy size and the good selection of the material.

K. E. GUTHE.

STATE UNIVERSITY OF IOWA.

*Die heterogenen Gleichgewichte vom Standpunkte der Phasenlehre.* By H. W. BAKHUIS ROOZEBOOM. Zweites Heft: Systeme aus zwei Komponenten. Erster Teil. 14 x 22 cm.; pp. xii + 465. Braunschweig, Friedrich Vieweg und Sohn. 1904.

In this volume the author discusses equilibrium phenomena for two-component systems in which only the components can occur as solid phases. Compounds and solid solutions are to be considered in a later volume. Mixtures of gases apparently do not come under the scope of the book and the author starts off with the equilibrium between liquid and vapor. We have the boiling-point curves for mixtures which give neither a maximum nor a minimum boiling-point, for pairs of liquids with a constant maximum boiling-point, and for pairs of liquids with a constant minimum boiling-point. We also have the pressure-con-

centration curves for these systems at constant temperature. In addition to a discussion of the possible qualitative forms of the partial pressure curves, there is a consideration of the quantitative values with special reference to the formulas of Duhem, van der Waals and van't Hoff. The only thing lacking in this summary is a statement of the relation between the heat of dilution and the displacement of a maximum or minimum boiling-point with change of pressure.

Next in order is a discussion of the complete freezing-point curve. Of special interest is the chapter on the methods of determining the freezing-point curves and the nature of the solid phases. We can locate a freezing-point curve either thermally by cooling- or heating-curves, or analytically by solubility determinations at constant temperature. For aqueous solutions the latter method is usually the more accurate; but the thermal method is the better for alloys and fused salts, owing to the difficulty of pipetting off the pure solution.

Roozeboom groups the methods for determining the nature of a solid phase under the headings: 'Direct Analysis,' 'Microscopic Examination,' 'Conductivity,' 'Electromotive Force,' 'Heat of Formation,' 'Other Methods.' While these methods have all been used more or less extensively, they are of very unequal value. When possible, isolation of the solid phase and direct analysis is the most accurate of all. This, however, is usually not feasible in the case of alloys and is often unsatisfactory with efflorescing salts. Microscopic examination is the only method which is of real value for alloys. The methods grouped under conductivity and electromotive force are worthless as general methods and are not to be recommended in special cases except as giving corroborative evidence. Much the same may be said of density determinations, while no one has ever got any results by determining the heat of formation of alloys.

The last portion of the book is devoted to a consideration of equilibrium under high pressures, the phenomena near the critical points forming a special case under this general heading. While interesting in itself and important from a theoretical point of view, this section will probably appeal less to the average chemist than will other portions of the book, because relatively few of us have ever had the opportunity of working with high pressures.

Wilder D. Bancroft.

## *SCIENTIFIC JOURNALS AND ARTICLES.*

*The American Naturalist* for November contains the following articles: 'Collection and Preparation of Material for Classes in Elementary Zoology,' by B. G. Smith, giving the methods in use at the University of Michigan; 'A New Ostracod from Nantucket, *Cyprinotus americanus*,' by Joseph A. Cushman; 'Further Notes on *Hyla andersonii* and *Rana virgatipes* in New Jersey,' by W. T. Davis; 'A Systematic Study of the Salicaceæ,' by D. P. Penhallow; the concluding paper containing a synopsis of the genera and species and list of literature on the subject. 'Momentum in Variation,' by F. B. Loomis, is an all too brief attempt to explain the development of parts beyond the point of apparent utility. Many of the statements need qualification, many are erroneous, and the subject is not one to be disposed of in five pages; it is safer to say we do not know.

*The American Journal of Anatomy* for December contains the following articles:

John Warren: 'The Development of the Paraphysis and the Pineal Region in *Necturus maculatus*.' 23 text-figures.

E. T. Bell: 'The Development of the Thymus.' 3 plates and 5 text-figures.

J. S. Ferguson: 'The Veins of the Adrenal.' 3 text-figures.

George Walker: 'The Blood Vessels of the Prostate Gland.' 2 colored plates.

B. M. Allen: 'The Embryonic Development of the Rete-Cords and Sex-Cords of *Chrysemys*.' 1 double plate and 6 text-figures.

F. T. Lewis: 'The Development of the Lymphatic System in Rabbits.' 8 text-figures.

F. T. Lewis: 'The Development of the Veins in the Limbs of Rabbit Embryos.' 1 text-figure.

A notice to members of the Association of American Anatomists of the approaching meeting, Christmas week.

*The Annual Report* of the Public Museum of Milwaukee, for the year ending August 31,